

U.S. Patent Application Serial No. 10/649,732

Response filed March 2, 2007

Reply to OA dated December 11, 2006



AMENDMENTS TO THE CLAIMS:

Please amend claims 12 and 22 and add new claim 33, as follows. This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-11 (Canceled).

Claim 12 (Currently Amended): A method of producing a microporous polyolefin membrane, comprising the steps of extruding a solution composed of 10 to 50 weight % of (A) a polyolefin having a weight-average molecular weight of 5×10^5 or more or (B) a composition containing this polyolefin and 50 to 90 weight % of a solvent, into a gel-like formed article and removing the solvent therefrom, wherein a treatment step with a hot solvent is ~~incorporated~~ performed on the gel-like formed article.

Claim 13 (Original): The method of producing a microporous polyolefin membrane according to Claim 12, wherein said treatment step with a hot solvent is effected at from the crystal dispersion temperature to melting point plus 10°C of said (A) polyolefin or (B) polyolefin composition.

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Claim 14 (Previously Presented): The method of producing a microporous polyolefin membrane according to Claim 12, wherein said treatment step with a hot solvent is effected prior to said step of removing the solvent.

Claim 15 (Previously Presented): The method of producing a microporous polyolefin membrane according to Claim 12, wherein said treatment step with a hot solvent is effected subsequent to said step of removing the solvent.

Claim 16 (Previously Presented): The method of producing a microporous polyolefin membrane according to Claim 12, wherein said polyolefin (A) has a weight-average molecular weight of 1×10^6 to 15×10^6 .

Claim 17 (Previously Presented): The method of producing a microporous polyolefin membrane according to Claim 12, wherein said polyolefin composition (B) is composed of an ultra-high-molecular-weight polyolefin having a weight-average molecular weight of 1×10^6 to 15×10^6 and a polyolefin having a weight-average molecular weight of 1×10^5 or more but less than 1×10^6 .

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Claim 18 (Previously Presented): The method of producing a microporous polyolefin membrane according to Claim 12, wherein said polyolefin composition (B) contains an ultra-high-molecular-weight polyolefin having a weight-average molecular weight of 7×10^5 or more at 1 weight % or more.

Claim 19 (Previously Presented): The method of producing a microporous polyolefin membrane according to Claim 12, wherein said polyolefin (A) or polyolefin composition (B) has a weight-average molecular weight/number-average molecular weight ratio (M_w/M_n) of 300 or less.

Claim 20 (Previously Presented): The method of producing a microporous polyolefin membrane according to Claim 12, wherein said polyolefin (A) or polyolefin composition (B) has a weight-average molecular weight/number-average molecular weight ratio (M_w/M_n) of 5 to 50.

Claim 21 (Previously Presented): The method of producing a microporous polyolefin membrane according to Claim 12, wherein said polyolefin (A) or polyolefin for said composition (B) is polypropylene or polyethylene.

Claim 22 (Currently Amended): The method of producing a microporous polyolefin membrane according to Claim 12, wherein the average pore size (a) in the area from the surface to a depth of $d/16$ (d: thickness of said membrane) is 0.05 to 50 μm , ~~preferably 1 to 30 μm~~ , and the average pore size (b) in the other area is 0.01 to 30 μm , ~~preferably 0.03 to 2 μm~~ , where the relationship $(b) < (a)$ ~~should hold~~ holds.

Claim 23 (Previously Presented): The method of producing a microporous polyolefin membrane according to Claim 12, wherein said polyolefin composition (B) is composed of a polyolefin having a weight-average molecular weight of 5×10^5 or more and polyolefin having a weight-average molecular weight of 1,000 to 4,000 and melting point of 80 to 130°C.

Claim 24 (Previously Presented): The method of producing a microporous polyolefin membrane according to Claim 12, wherein said polyolefin composition (B) is composed of (B-1) an ultra-high-molecular-weight polyolefin having a weight-average molecular weight of 5×10^5 or more and (B-2) a polyolefin having a weight average molecular weight of less than 5×10^5 , the (B-2)/(B-1) weight ratio being 0.2 to 20.

Claim 25 (Previously Presented): The method of producing a microporous polyolefin membrane according to Claim 12, wherein said polyolefin composition (B) is composed of a polyolefin having a weight-average molecular weight of 5×10^5 or more and polypropylene having a weight-average molecular weight of 3×10^5 or more.

Claim 26 (Previously Presented): The method of producing a microporous polyolefin membrane according to Claim 12, wherein said polyolefin composition (B) is composed of a polyolefin having a weight-average molecular weight of 5×10^5 or more and ethylene-based copolymer having a melting point of 95 to 125°C and produced in the presence of a single-site catalyst.

Claim 27 (Previously Presented): The method of producing a microporous polyolefin membrane according to Claim 12, wherein said polyolefin composition (B) is composed of 1 to 69 weight % of an ultra-high-molecular-weight polyolefin having a weight-average molecular weight of 7×10^5 or more, 98 to 1 weight % of a high-density polyethylene, and 1 to 30 weight % of a low-density polyethylene.

Claim 28 (Previously Presented): The method of producing a microporous polyolefin membrane according to Claim 12, further comprising the step of stretching said gel-like article.

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Claim 29 (Original): The method of producing a microporous polyolefin membrane according to Claim 28, wherein said stretching step is effected at an areal ratio of 15 to 400.

Claim 30 (Withdrawn): A battery separator which uses the microporous polyolefin membrane according to Claim 1.

Claim 31 (Withdrawn): A battery which uses the microporous polyolefin membrane according to Claim 1 for its separator.

Claim 32 (Canceled).

Claim 33 (New): The method of producing a microporous polyolefin membrane according to Claim 22, wherein the average pore size (a) in the area from the surface to a depth of $d/16$ (d: thickness of said membrane) is 1 to 30 μm , and the average pore size (b) in the other area is 0.03 to 2 μm .